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Evaluation of Monitoring Audiometry in the United Stated Air Force Hearing Conservation Program

Proposal

Presented in Partial Fulfillment of the Requirements for Civilian Institution, AFIT Sponsored Doctor of Philosophy

By

Theresa Y. Schulz, Major, USAF, BSC, M.A.

* * * * *

The Ohio State University

1993

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Problem Statement

Components of a comprehensive hearing conservation program have been enumerated by many experts (Gasaway, 1985; Royster et al., 1982; Stewart, 1988; Suter, 1986) as follows:

(1) Noise level measurement.

(2) Identification of individuals who are exposed to excessive noise levels.

(3) Engineering and administrative controls to reduce excessive noise levels.

(4) Personal hearing protection.

(5) Education and motivation of noise exposed workers and management.

(6) Monitoring audiometry.

(7) Record keeping.

(8) Program evaluation.

The purpose of this study is to evaluate the effectiveness and efficiency of the methods and procedures of audiometric monitoring (#6 above) as used in the United States Air Force (USAF) Hearing Conservation Program (HCP). These program elements are common to HCPs both in the other military services (U.S. Army and Navy) and in civilian industry. However, there are a multitude of variations in implementing these common elements of a HCP. The minimal requirement of monitoring

audiometry is addressed in the Occupational Safety and Health Administration (OSHA) Noise Standard, Code of Federal Regulations, Title 29, Chapter XVII, Part 1910.95, March 8, 1983. This regulation is referred to by OSHA as "the final rule." It states (in part): "The employer shall establish and maintain an audiometric testing program as provided in this paragraph by making audiometric testing available to all employees whose exposures equal or exceed an 8-hour time-weighted average of 85 dB." The regulation specifies that a baseline audiogram shall be established within 6 months of an employee's first exposure against which subsequent audiograms can be compared. The baseline is to be preceded by at least 14 hours without exposure to workplace noise. "At least annually after obtaining the baseline audiogram, the employer shall obtain a new audiogram for each employee exposed at or above an 8 hour time-weighted average of 85 dB. . . . If the annual audiogram shows that an employee has suffered a standard threshold shift, the employer may obtain a retest within 30 days and consider the results of the retest and the annual audiogram." OSHA defines a standard threshold shift as "a change in hearing threshold relative to the baseline audiogram of an average of 10 dB or more at 2000, 3000, and 4000 Hz in either ear" (OSHA, 1983). The OSHA requirements are considered the minimal requirements for an effective hearing conservation program. Measures taken above these minimal requirements may result in a more effective and efficient HCP.

Webster defines effective as "adequate to accomplish a purpose; producing the intended or expected result," and efficient as "performing or functioning effectively with the least waste of time an effort." This distinction will be made between the specific research questions addressed. Efficacious (adjective) and efficacy (noun) will be used interchangeably with effective. This study does not address the pure tone audiometric test itself, but rather how it is used in the context of monitoring audiometry in military/industrial hearing conservation programs.

Audiometry, as used in hearing conservation programs, is a tool to detect both temporary threshold shift (TTS) and permanent threshold shift (PTS) and to discriminate between the two. Melnick (1984) emphasizes the importance of hearing testing as part of a hearing conservation program, since identification of temporary threshold shift (TTS) allows the possibility of finding the cause of this temporary loss and implementing corrective action. Even if the hearing loss is permanent, detection can lead to prevention of further progression of the hearing loss. Threshold shift is defined as the difference between hearing thresholds (in decibels) measured before and after exposure to noise. If the change in hearing levels recovers after the exposure to pre-noise exposure levels, the change is called a temporary threshold shift (TTS). If, however, hearing levels do not return to pre-noise exposure levels, the change is called a permanent threshold shift (PTS). The physical properties of the

noise such as sound pressure level, duration, spectrum and temporal pattern effect the formation of and recovery from TTS. Individual variability is also an important factor effecting TTS (Melnick, 1979).

Audiometry is also an important tool in evaluating the effectiveness of a hearing conservation program. However, the primary issue addressed in this study is the use of audiometry to detect TTS and PTS.

Monitoring Audiometry in the USAF HCP

The United States Air Force (USAF) Hearing Conservation Program (HCP) is described in the Air Force Occupational Safety and Health (AFOSH) Standard 161-20 published 15 October 1991. The purpose of the USAF HCP is to "protect Air Force personnel from the harmful effects of hazardous noise." Major Commands (MAJCOMs) may supplement this standard with more stringent criteria but cannot replace any part of the standard with less stringent criteria or procedures. AFOSH Standard 161-20 "meets or exceeds requirements of the Occupational Safety and Health Administration (OSHA) regulation 29 Code of Federal Regulations (CFR) 1910.95, 'Occupational Noise Exposure', 5 CFR 339, Federal 'Personnel Manual', and Department of Defense Instruction (DoDI) 6055.12, 'Hearing Conservation'" (AFOSH Standard 161-20, 1991).

Suter (1988) defines standard as "a codified set of rules or guidelines, often used interchangeably with the term regulation" and regulation as "a rule order prescribed by an authority (the government, for example), usually a rule or set of rules that is somewhat more formal than a standard." This is in contrast to laws which are "enacted by our elected representatives".

Definitions (directly from AFOSH Standard 161-20)

Audiogram. The measurement of an individual's hearing sensitivity expressed in decibels as a function of frequency. Data are reported in graphic or numeric form.

Annual audiogram. An audiogram performed at least every 12 months.

Close scrutiny audiograms. Frequently administered audiograms used to more closely monitor an individual or group. When, on whom, and how often to perform close scrutiny exams is determined by the examining practitioner.

Noise-free audiograms (15 and 40 hr. follow-up). An audiogram done after an individual has been noise-free for a minimum specified amount of time.

Noise-free period. A time period free of steady state noise above 72 dB(A) or impulse noise above 120 dB peak. As a guide, a noise free period should be free of exposure to noise loud enough to require the use of a raised voice at three feet.

Reference audiogram. An audiogram used as a baseline to compare subsequent audiograms against, to determine if hearing loss has occurred. All persons entering employment in hazardous noise must receive a reference audiogram.

Termination audiogram. A hearing test administered when an individual discontinues duties involving hazardous noise exposure.

Detailed Follow-up Program (DFU). A program of monitoring to determine if an individual's hearing loss is progressive. Workers who have permanent threshold shifts are enrolled in the program for six months and receive an audiogram at three months and six months.

Standard Threshold Shift (STS). A change for the worse in hearing threshold relative to the reference audiogram of an average of 10 dB at 2000, 3000, and 4000 Hz, either ear. That is, if the sum of the shifts at 2000, 3000, and 4000 Hz in the right ear or left ear exceeds 30 dB, an STS has occurred.

- Temporary Threshold Shift (TTS). A temporary loss of hearing due to exposure to high intensity noise. In the USAF hearing conservation program any standard threshold shift found on monitoring audiometry which disappears after a 15 or 40 hour noise-free period is a TTS.
- Permanent Threshold Shift (PTS). In the USAF hearing conservation program any STS found on monitoring audiometry which is still present after a 40 hour noise-free period is considered a PTS.

Hazardous noise. Either:

-An eight hour equivalent continuous A-weighted sound level greater than 85 decibels, or intermittent (non-impact) noise above 115 decibels.

-Impulse or impact noise greater than 140 decibels peak sound pressure level (SPL).

Reference, 90 Day Follow-up and Annual Audiograms

The USAF HCP audiogram consists of threshold measurements in 5 dB steps at the frequencies 500, 1000, 2000, 3000, 4000 and 6000 Hz each ear. All persons assigned to hazardous noise duties, military and civilian, are required to have a reference established within 30 days of entering the noise hazardous job. "It is strongly recommended that workers receive a replacement exam BEFORE they begin working in a hazardous noise exposed job" (AFOSH Standard 161-20). Reference audiograms are performed when the employee has been "noise-free" for at least 15 hours in order to minimize TTS. Between October 1956 and June 1990, an additional audiogram was required by regulation to be completed within 90 days of the original reference. This 90 day follow-up was designed to verify the reference and also to detect any TTS early so that action could be taken to prevent PTS. That action could be re-training and motivating the employee on the use of hearing protection, re-fitting hearing protective devices,

additional follow-up audiometry (i.e. close scrutiny exams) or referral to a clinical provider.

The annual audiograms are performed with no noise-free criteria in order to detect TTS and/or PTS. If the employee is protected against hazardous noise levels, no noise-induced hearing loss should be present. If an STS is noted, it must be determined whether the hearing loss is due to noise-induced TTS or PTS, or some other reason.

15 and 40 Hour Noise-free Follow-up

When an STS is noted on the annual audiogram, a follow-up audiogram is performed after a noise-free period of at least 15 hours. Like the reference audiogram, the 15 hour noise-free period is used to minimize TTS. However, based on the assumption that some TTS might be present even at 15 hours noise-free, if the STS is still present, a second follow-up audiogram is performed when the employee is noise-free for at least 40 hours. See attached flow chart. The efficiency of this two step follow-up procedure is examined.

STS Criteria

An issue of crucial importance to any HCP is the criteria for determining STS, that is, the cut point for positive (abnormal)

vs. negative (normal) finding for an audiometric test. Gasaway and Sutherland (1976), Gasaway (1985), Royster and Royster (1982), Dobie (1983), Lane et al. (1985) and Royster (1992) have evaluated various criteria for significant threshold shift. No consensus has been reached. The goal of an appropriate STS criteria is to identify individuals early in the process of noise-induced hearing loss before serious hearing loss occurs but to avoid falsely identifying normal variability as noise-induced hearing loss.

This investigation compares current OSHA criteria for "Standard Threshold Shift" with several alternative criteria for their ability to detect "true STS". True STS is determined by applying the same STS criterion to the next audiogram for that individual. If the STS persists, the change in hearing must be assumed to be true. The alternative criteria were gleaned from the literature (Gasaway and Sutherland, 1976; Gasaway 1985; Dobie, 1983; Lane et al. 1985; Royster and Royster 1982; Royster, 1992) and include the criteria currently being considered by the Department of Defense (DoD) Hearing Conservation Working Group. This Working Group consists of the program managers of the Air Force, Army and Navy hearing conservation data registries. One of their missions is to standardize the HCPs in the DoD as much as possible. The agenda of the most recent meeting in March, 1993, included the issue of significant threshold shift criteria. It was agreed

that further evaluation of alternative criteria is needed (personal communication with Working Group members).

90 Day Follow-up

The effectiveness of the 90 day follow-up audiogram is evaluated. This audiometric test was completed within 90 days after the first reference was established. The requirement for this audiogram was deleted in June 1990, based primarily on non-compliance and without formal evaluation of it's efficacy.

Incidence of improved thresholds or worsened thresholds will be determined from a "model program" that faithfully accomplished 90 day follow-up audiograms. The 90 day follow-up program is evaluated based on its performance as an effective screening tool. The gold standard or truth is established by looking at the subsequent audiogram(s) as explained above.

Detailed Follow-up

A procedure unique to the USAF and Navy HCPs is the use of detailed follow-up (DFU) program (called Detailed Surveillance by the Navy). Meyer and Wirth (pending publication) recently evaluated the overall effectiveness of the DFU and concluded that the "DFU is a 'no value added' process of the USAF HCP." The DFU, by definition, is used "to determine if an individual's

hearing loss is progressive" (AFOSH 161-20, 1991). However, it may be inappropriate to require that all individuals showing PTS be enrolled in the DFU program since there is such a low incidence of rapidly progressive hearing loss in that population (92/1377 or 6.68% in the Meyer and Wirth study).

Meyer and Wirth did not evaluate the characteristics of the individuals who do show a progressive hearing loss during the DFU. The cases of "unstable" or progressing hearing loss will be examined more closely, especially according to years since original reference date. Those "unstable" cases may have more recent references (which would provide further evidence of progression of the hearing loss), or some other characteristic different than the stable cases.

Methods

All USAF personnel (military and civilian) exposed to hazardous noise in the normal course of their duty must receive a reference audiogram and annual audiograms in accordance with AFOSH 161-20. The reference audiogram is recorded on DD Form 2215 and annual audiograms as well as 15 and 40 hour noise-free audiograms, if required are recorded on DD Form 2216. See attached copies of DD Forms 2215 and 2216. When the first permanent threshold shift is noted on the 40 hour noise-free follow-up, the individual is

enrolled in the Detailed Follow-up program. Data for the DFU evaluations are recorded on AF Form 1671. See attached example of AF Form 1671. Data are stored in the US Air Force Hearing Conservation Data Registry (HCDR) at Brooks AFB, TX. The data for these studies are taken from the Master Database only (1989 - 1992) and are from DD Form 2215s, DD Form 2216s and AF Form 1671s. Data for both active duty military and AF civilian employees, stratified by gender are available.

The data are summarized using traditional descriptive statistics. The research questions will be addressed as described below.

Is the 40 hour noise-free follow-up an effective use of audiometry?

To evaluate the efficiency of monitoring audiometry as used in the 15 and 40 hour noise-free follow-up process, I will compare the sensitivity and specificity of the 15 and 40 hour noise-free audiograms individually with the current process of doing both follow-up audiograms. The predictive value of the 15 hour follow-up alone vs. the predictive value of both follow-ups as currently applied were determined. The prevalence of true STS was determined over the four years of data. This evaluation assumes the prevalence of STS will remain constant.

The 2x2 table used to calculate the measures of sensitivity, specificity, and predictive value is constructed as follows:

	CONFIRMED CONDITION	
RESULT OF TEST	PTS	No PTS
STS Present	True Positive (TP)	False Positive (FP)
No STS	False Negative (FN)	True Negative (TN)

As can be seen from the table above, the truth or gold standard must be known in order to fill the cells. For the detection of noise induced hearing loss, the gold standard is difficult to define. We cannot count hair cells in a living person to determine the normal vs. abnormal ears. A diagnostic audiometric evaluation cannot feasibly be accomplished for every individual with a small change in hearing. And even diagnostic audiometry cannot diagnose noise induced hearing loss with absolute certainty since the characteristic of other etiologies mimic noise induced hearing loss.

The gold standard or truth is therefore, determined based on the next non-noise-free audiogram after the follow-up process is completed (i.e. the diagnostic audiogram, the first DFU audiogram, or the next year's annual audiogram).

In addition to traditional measures of sensitivity and specificity, measures from Detection Theory will be used. These Detection Theory measures, such as d′ (d prime) and Δm (delta m) allow the sensitivity to be measured independent of the criteria used. The index d′ is used when the distribution of concern have equal variance, and Δm does not assume equal variance. The working definitions are the same:

$$d' = z(TP) - z(FP)$$

$$\Delta m = z(TP) - z(FP)$$

The z-transformation converts the TP and FP rates to z-scores, which are in standard deviation units. This is done by using a normal distribution table. A $d'/\Delta m$ of 0 indicates results are due to chance alone, there are equal number of true positive responses and false positive responses. Higher values of $d'/\Delta m$ indicate increased sensitivity. In theory, $d'/\Delta m$ is infinite for perfect performance, however, a common practice is to convert 0% and 100% performance to create a ceiling where $d'/\Delta m$ rarely exceeds 5. For example, if 99.5% of the responses are true positives and 0.5% are false positives, the z-score conversion for 0.995 is 2.576 and for 0.005 is -2.576. Substituting these values in the $d'/\Delta m$ equation:

$$d'/\Delta m = z(TP) - z(FP)$$

$$d'/\Delta m = 2.576 - (-2.576)$$

$$d'/\Delta m = 5.152$$

Note that Sensitivity uses TP and FN and d′ uses TP and FP.

The locus of all True Positive and False Positive pairs that results in a constant d'/Δm is an isosensitivity curve, that is, all points on the curve have equal sensitivity. The Detection Theory term for this is receiver operating characteristic (ROC). ROC's are plotted on a graph with the False Positive rate on the x-axis and the True Positive on the y-axis (MacMillian and Creelman, 1991).

Issues to consider include the cost of the 40 hour noise-free audiogram vs. the benefit of the increased specificity and predictive value. The cost/benefit will be addressed in relative terms.

Is the DFU program an effective use of audiometry?

The DFU program as defined in AFOSH Standard 161-20 is used as a screening tool on all individuals identified as showing PTS. The incidence of rapidly progressive hearing loss is low in that population in general.

Sound screening principles require relatively high prevalence or incidence of disease in order to get good estimate of predictive value from a screening test (Ahlbom and Norell, 1990). An

analysis of the characteristics of those individuals that have shown a rapidly progressive hearing loss on DFU might suggest a subset of all individuals with PTS that are at "high risk" of rapidly progressive hearing loss. There is limited information available about the pertinent characteristics of the population, however, some possible explanatory variables are available including years since original reference, age, occupation code, military vs. civilian worker, and rank/grade (which can be used as a surrogate variable for years of exposure). See DD Forms 2215 and 2216. Regression analysis with the above characteristics as independent variables modeled on the outcome variable of "unstable" or rapid progression of hearing loss will be accomplished.

Which STS criterion or criteria is/are best?

This portion of the study compares current OSHA criteria for Standard Threshold Shift with several alternative criteria for their ability to detect "true STS". The criteria are listed below:

(1) OSHA: a 10 dB average shift at 2000, 3000 and 4000 Hz, either ear,

(2) AF: a change of 20 dB at any frequency 1000 - 4000 Hz, either ear,

(3) NAVY: 15 dB shift at any frequency 1000 - 4000 Hz, either ear,

(4) NIOSH: a change of 10 dB or more at 500, 1000, 2000, or 3000 Hz and/or 15 dB or more at 4000 or 6000 Hz, either ear,

(5) AAO-HNS: a change of 10 dB or more in the average of hearing thresholds at 500, 1000, and 2000 Hz and/or at 3000, 4000, and 6000 Hz, either ear, and

(6) 10 dB Avg.: a change of 10 dB or more in the average of 3000 and 4000 Hz, either ear.

Combinations of criterion are also evaluated. Again the gold standard or truth will be the next audiogram after the follow-up process is completed. Traditional sensitivity and specificity measures as well as ROC curves will be used to analyze the data.

The cost/benefit of each STS criteria must be considered. Dobie (1983) arbitrarily assumed the ratio of False Positive cost to False Negative cost to be about 4 to 1. That is, he was willing to accept four False Positives for every True Positive case. He opines that half of the True Positives are due to presbycusis (hearing loss due to aging). Higher False Positive cost to False Negative cost ratios will require more stringent criteria for STS. I will display various cost/benefit ratios and their relationship to the ROC curves. This allows the reader to

determine the STS criteria that best matches their own acceptable cost/benefit ratio.

Is the 90 day follow-up an efficient use of audiometry?

This aspect of the study evaluates the efficiency of the 90 day follow-up. The requirement for this audiogram was deleted based primarily on non-compliance and without formal evaluation of it's efficiency.

Presence of improved thresholds or worsened thresholds will be determined from two "model programs" that faithfully accomplished 90 day follow-up audiograms. The 90 day follow-up requirement was rescinded in June 1990. The efficiency of the 90 day follow-up program will be evaluated using the test-retest reliability methods detailed by Dobie (1983). The data for this part of the study are limited to a time period (1989) and bases (McClellan and Hill AFBs) that I have personal knowledge were accomplishing the 90-day follow-up faithfully. To evaluate this aspect, I will use all DD 2216's marked as 90-day follow-ups as well as any subsequent audiograms, especially the following annual audiogram for each of those SSANs. The same data fields as noted in the DFU study above are available.

Research Questions

The research questions are summarized below:

(1) Evaluate the efficiency of monitoring audiometry as used in the 15 and 40 hour noise-free follow-up process of the USAF HCP.

(2) Compare current OSHA criteria for Standard Threshold Shift with several alternative criteria for their efficiency in detecting "true STS".

(3) Investigate characteristics of the population on whom DFU may be indicated.

(4) Evaluate the effectiveness of the 90 day follow-up.

Included in the assessment of the above issues is the compliance with the process as specified in the current regulation (except the 90 day follow-up, which is not currently required). An overall evaluation and recommendation for changes in AFOSH 161-20 (the regulation that governs this program) will facilitate the evolution of the USAF HCP.

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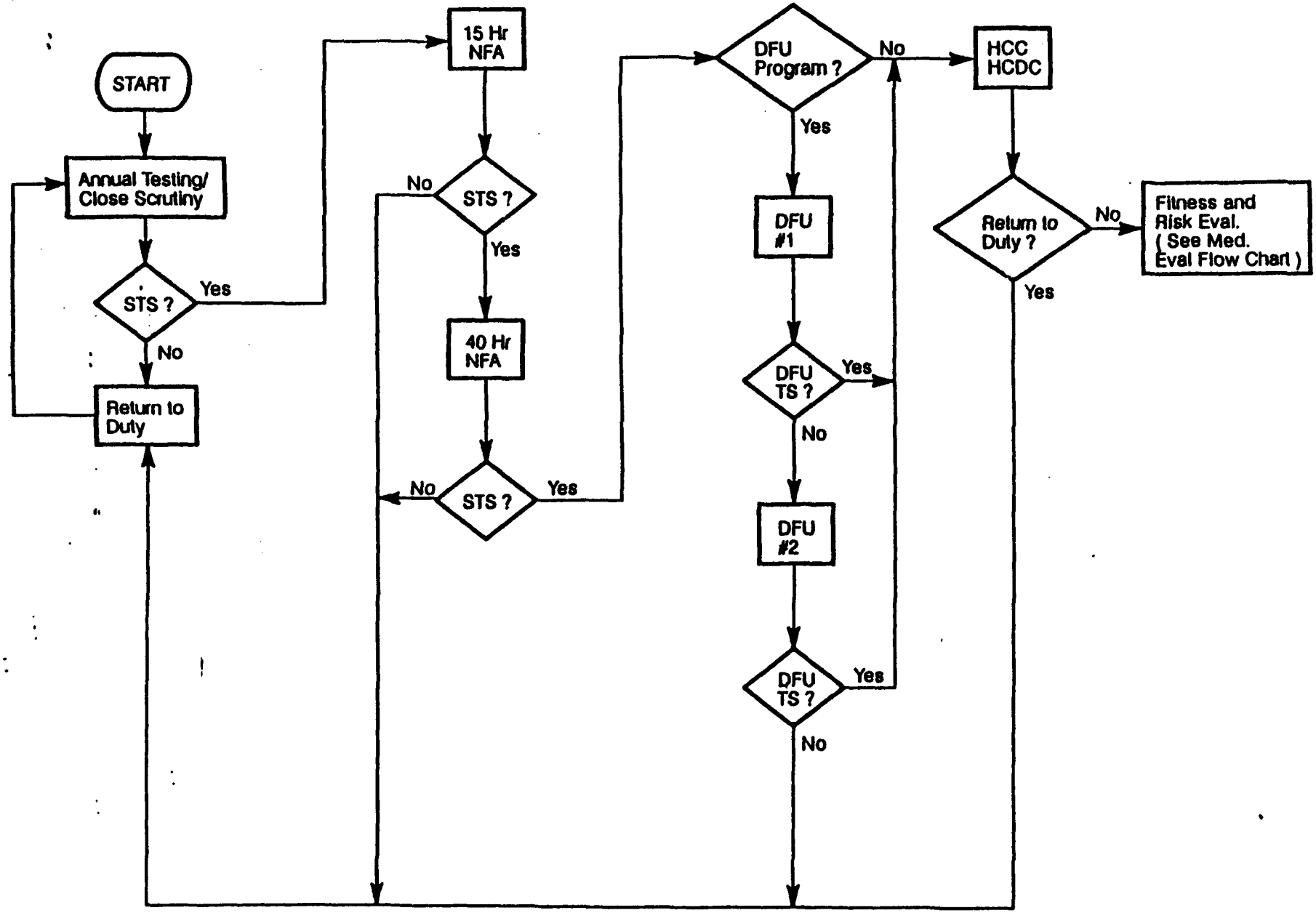
Audiometric Monitoring Flow Chart



REFERENCE AUDIOGRAM

(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974 - Use Blanket PAS - DD Form 2005)

ZIP CODE/APO

DOD COMPONENT ☐
A–ARMY M–MARINE CORPS
N–NAVY 1–OTHER DOD ACTIVITY
F–AIR FORCE

SERVICE COMPONENT ☐
R–REGULAR G–NATIONAL GUARD
V–RESERVE 1–OTHER

PERSONAL DATA

SSN

LAST NAME–FIRST NAME–MIDDLE INITIAL

SEX ☐ M–MALE F–FEMALE

DATE OF BIRTH (year / month / day)

PAY GRADE, UNIFORMED SERVICES

GRADE, CIVILIAN

SERVICE DUTY OCCUPATION CODE

MAILING ADDRESS OF ASSIGNMENT

LOCATION–PLACE OF WORK

MAJOR COMMAND

DUTY PHONE

AUDIOMETRY

☐
1. REFERENCE ESTABLISHED PRIOR TO INITIAL DUTY IN HAZARDOUS NOISE AREAS
2. REFERENCE ESTABLISHED FOLLOWING EXPOSURE IN NOISE DUTIES
3. REFERENCE RE–ESTABLISHED AFTER FOLLOWUP PROGRAM

HEARING THRESHOLD LEVELS OF TEST FREQUENCIES RE: ANSI S3.6

LEFT EAR						RIGHT EAR					
500	1000	2000	3000	4000	6000	500	1000	2000	3000	4000	6000

DATE OF AUDIOGRAM (year / month / day)

DAY OF WEEK ☐ 1-SUN 2-MON 3-TUES 4-WED 5-THURS 6-FRI 7-SAT

MIL-TIME-DAY

HOURS SINCE LAST NOISE EXPOSURE

ENT PROBLEM AT TIME OF TEST ☐ 1–NO 2–YES 3–UNKNOWN

EXAMINER

LAST NAME–FIRST NAME–MIDDLE INITIAL

TRAINING CERT NO.

SSN

SERVICE DUTY OCCUPATION CODE

OFFICE SYMBOL

AUDIOMETER

TYPE ☐ 1-MANUAL 2-SELF-RECORDING (automatic) 3-MICROPROCESSOR

MODEL

MANUFACTURER

SERIAL NUMBER

LAST ELECTROACOUSTIC CALIB DATE (year / month / day)

PERSONAL HEARING PROTECTION

TYPE USED ☐ 1-SINGLE FLANGE (V51R) 2-TRIPLE FLANGE 3-HAND FORMED EARPLUGS 4-EAR CANAL CAPS 5-NOISE MUFFS 6-OTHER

EARPLUGS ISSUED 1-NO 2-YES ☐ 3-PREVIOUSLY ISSUED

SIZE EARPLUGS (R / L) 1-XS 2-S 3-M 4-L 5-XL

DOUBLE PROTECTION USED ☐ 1-NO 2-YES

GLASSES WORN (including goggles) ☐ 1-NO 2-YES

FREQUENCY GLASSES WORN ☐ 1-ALWAYS 2-SELDOM 3-N/A

REMARKS

CONTENTS REVIEWED AND VALIDATED BY

NAME OF REVIEWER *(Signature)*

SERVICE DUTY OCCUPATION CODE

AUTOVON

SSN

OFFICE SYMBOL

DD FORM 1 SEP 79 2215 REPLACES AF FORM 1491, MAR 73, WHICH IS OBSOLETE.

HEARING CONSERVATION DATA

ZIP CODE/APO

DOD COMPONENT: A-ARMY, N-NAVY, F-AIR FORCE, M-MARINE CORPS, 1-OTHER DOD ACTIVITY

SERVICE COMPONENT: R-REGULAR, V-RESERVE, G-NATIONAL GUARD, 1-OTHER

SSN | LAST NAME—FIRST NAME—MIDDLE INITIAL | SEX (M-MALE, F-FEMALE) | DATE OF BIRTH (year, month, day)

PAY GRADE, UNIF SVCS | GRADE, CIVILIAN | SERVICE DUTY OCCUPATION CODE | MAILING ADDRESS OF ASSIGNMENT

LOCATION—PLACE OF WORK | MAJOR COMMAND | DUTY PHONE

AUDIOMETRY

PURPOSE: 1—60 DAY | 2—ANNUAL | 3—TERMINATION | 4—OTHER

AUDIOMETRIC DATA RE: ANSI S3.6

	LEFT						RIGHT					
	500	1000	2000	3000	4000	6000	500	1000	2000	3000	4000	6000
CURRENT AUDIOGRAM DATE (year, month, day)												
REFERENCE AUDIOGRAM DATE (year, month, day)												
THRESHOLD SHIFT (+ = Poorer, — = Better)												

1-No Significant threshold shift
2-Yes ± 20dB or greater

STS NO: ● Counsel ● Return to duty ● Retest in 12 mo. ● Validated by reviewer ● Orig in health record ● Send copy to registry

STS YES: ● Notify supervisor ● Followup No. 1 after minimum 15 hours noise free

NAME OF EXAMINER (Last, first, MI) | TRAINING CERT. NO. | SSN | SERVICE DUTY OCCUPATION CODE | OFC SYMBOL

TYPE: 1-Manual, 2-Self-recording (auto), 3-Microprocessor | MODEL | MANUFACTURER | SERIAL NO. | LAST ELECTROACOUSTIC CALIB DATE (year, month, day)

FOLLOWUP NO. 1 — Minimum 15 hours noise free

AUDIOMETRIC DATA RE: ANSI S3.6

	LEFT						RIGHT					
	500	1000	2000	3000	4000	6000	500	1000	2000	3000	4000	6000
CURRENT AUDIOGRAM DATE (year, month, day)												
REFERENCE AUDIOGRAM DATE (year, month, day)												
THRESHOLD SHIFT (+ = Poorer, — = Better)												

1-No Significant threshold shift
2-Yes ± 20dB or greater

STS NO: ● Counsel ● Return to duty ● Retest in 12 mo. ● Validated by reviewer ● Orig in health record ● Send copy to registry

STS YES: ● Notify Supervisor ● Cleared by medical reviewer before Followup No. 2

NAME OF EXAMINER (Last, first, MI) | TRAINING CERT. NO. | SSN | SERVICE DUTY OCCUPATION CODE | OFC SYMBOL

TYPE: 1-Manual, 2-Self-recording (auto), 3-Microprocessor | MODEL | MANUFACTURER | SERIAL NO. | LAST ELECTROACOUSTIC CALIB DATE (year, month, day)

FOLLOWUP NO. 2 — Minimum 40 hours noise free since Followup No. 1

AUDIOMETRIC DATA RE: ANSI S3.6

	LEFT						RIGHT					
	500	1000	2000	3000	4000	6000	500	1000	2000	3000	4000	6000
CURRENT AUDIOGRAM DATE (year, month, day)												
REFERENCE AUDIOGRAM DATE (year, month, day)												
THRESHOLD SHIFT (+ = Poorer, — = Better)												

Significant threshold shift ± 20dB or greater: 1-No 2-Yes

STS NO: ● Counsel ● Return to duty ● Retest in 12 mo. ● Validated by reviewer ● Orig in health record ● Send copy to registry

STS YES: ● Refer to appro directive ● Requires medical disposition ● Validated by reviewer ● Orig in health record ● Send copy to appro registry

NAME OF EXAMINER (Last, first, MI) | TRAINING CERT. NO. | SSN | SERVICE DUTY OCCUPATION CODE | OFC SYMBOL

TYPE: 1-Manual, 2-Self-recording (auto), 3-Microprocessor | MODEL | MANUFACTURER | SERIAL NO. | LAST ELECTROACOUSTIC CALIB DATE (year, month, day)

REVIEWED & VALIDATED BY | SERVICE DUTY OCCUPATION CODE | AUTOVON | SSN | OFC SYMBOL

DD Form 2216
1 SEP 79

DETAILED HEARING CONSERVATION DATA FOLLOWUP

(THIS FORM IS SUBJECT TO THE PRIVACY ACT OF 1974 - Use Blanket PAS - DD Form 2005)

ZIP CODE/APO

STATUS ☐ 1-ACTIVE 2-RESERVE 3-NATIONAL GUARD 4-CIVILIAN 5-OTHER

PERSONAL DATA

SSN

LAST NAME–FIRST NAME–MI

SEX ☐ 1–MALE 2–FEMALE

DATE OF BIRTH (year, month, day)

PAY GRADE ☐ e.g. E–3, GS–4, O–5, WG–10, etc.

AFSC

MAILING ADDRESS OF ASSIGNMENT

LOCATION–PLACE OF WORK

MAJOR COMMAND

DUTY PHONE

AUDIOMETRY [1]

DETAILED FOLLOWUP (DFU) NO. 1

____ HOURS SINCE LAST NOISE EXPOSURE ☐ 1–NO 2–YES HEARING PROTECTION WORN DURING EXPOSURE

AUDIOMETRIC DATA RE: ANSI S3.6	LEFT						RIGHT					
	500	1000	2000	3000	4000	6000	500	1000	2000	3000	4000	6000
CURRENT AUDIOGRAM DATE (year, month, day)												
REFERENCE AUDIOGRAM DATE (year, month, day)												
THRESHOLD SHIFT +=Poorer –=Better												

Threshold shift of 15dB or more at any frequency, either ear, is considered significant.

Significant threshold shift (STS) ☐ 1–No 2–Yes

STS YES
1-Medical referral required prior to followup No.2
2-If person is removed from noise duty, note this action under remarks, send copy to registry and place original in health record

STS NO
1-Return to duty
2-Retain this form
3-Retest in 3 months

EXAMINER

LAST NAME, FIRST NAME, MI

SSN

AFSC

OFC SYMBOL

AUDIOMETER

TYPE ☐ 1-MANUAL 2-SELF-RECORDING (auto) 3-MICROPROCESSOR

DETAILED FOLLOWUP (DFU) NO. 2

____ HOURS SINCE LAST NOISE EXPOSURE ☐ 1–NO 2–YES HEARING PROTECTION WORN DURING EXPOSURE

AUDIOMETRIC DATA RE: ANSI S3.6	LEFT						RIGHT					
	500	1000	2000	3000	4000	6000	500	1000	2000	3000	4000	6000
CURRENT AUDIOGRAM DATE (year, month, day)												
REFERENCE AUDIOGRAM DATE (year, month, day)												
THRESHOLD SHIFT +=Poorer –=Better												

Threshold shift of 15dB or more at any frequency, either ear, is considered significant

Significant threshold shift (STS) ☐ 1–NO 2–YES

STS YES
1-Medical referral to consider permanent removal from duties in noise
2-Send copy to registry
3-Place original in health record

STS NO
1-Return to duty
2-Send copy to registry
3-Place original in health record

Establish new reference on DD Form 2215 from:
☐ Interim reference
☐ Other (Specify in Remarks)

EXAMINER

HEARING CONSERVATION CERTIFICATE NO. _____

LAST NAME, FIRST NAME, MI

SSN

AFSC

OFC SYMBOL

AUDIOMETER

TYPE ☐ 1-MANUAL 2-SELF-RECORDING (auto) 3-MICROPROCESSOR

REMARKS (Use reverse if more space needed)

CONTENTS REVIEWED AND VALIDATED BY

NAME OF REVIEWER

AFSC

AUTOVON

SSN

OFC SYMBOL

[1] *INTERIM REFERENCE: extracted from 40 hr audiogram that validated significant threshold shift. The above audiograms are intended for 3rd and 6th month intervals.*

☆U.S. G.P.O. 1983-380-979/613